

FIG.1

PREDICTED vs ACTUAL COST COMPARISON
OF
TECHNOLOGY COST ESTIMATE WORKSHEET

| TECHNOLOGY | NAME | PREDICTED | ACTUAL | % DELTA |
|-------------|------------|-----------|---------|---------|
| CM4L 3LM | OMNI | \$872 | \$833 | 4.7% |
| CM4LP 3LM | PHEONIX | \$805 | \$856 | -6.0% |
| CM5S 4LM | MUSTANG | \$1,188 | \$1,121 | 6.0% |
| CM5S1 5LM | RACER | \$1,236 | \$1,227 | 0.7% |
| CM5X 4LM | APACHE | \$1,191 | \$1,152 | 3.4% |
| CM5X2 4LM | FURY | \$1,248 | \$1,167 | 6.9% |
| CM6S 4LM | HURRICANE | \$1,322 | \$1,340 | -1.3% |
| CM6S2 4LM | TIGGER | \$1,407 | \$1,299 | 8.3% |
| CM6S2 5LM | SC / 98 | \$1,560 | \$1,469 | 6.2% |
| CM6SF 4LM | PYTHON | \$1,531 | \$1,437 | 6.5% |
| CM6SF 5LM | LONGTRAIL | \$1,816 | \$1,691 | 7.4% |
| CM6X 4LM | TYPHOON | \$1,704 | \$1,670 | 2.0% |
| CM7S 6LM | LONESTAR | \$2,464 | \$2,607 | -5.5% |
| CM7SF 3LM | COMMANDER | \$1,918 | \$2,020 | -5.0% |
| CM8S 4LM | BLIZZARD | \$2,238 | \$2,240 | -0.1% |
| SIGE6SF | COPERNICUS | \$2,809 | \$2,726 | 3.0% |
| ICEC8S2 6LM | MAJESTIC* | \$3,214 | \$3,325 | -3.3% |
| ICEC9S 7LM | MAKO** | \$3,870 | \$3,534 | 9.5% |

* Predictive Cost Estimated 12 Months Prior to Actual

** Predictive Cost Estimated 18 Months Prior to Actual

FIG.2

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| TECHNOLOGY COST ESTIMATE WORKSHEET | | | | | | | | | | | | | | |
|---|--|--|---------------------------|---|---|--|---|--|---|---|---|---|---|---|
| FOR THE FOLLOWING TECHNOLOGIES: | | | | | | | | | | | | | | |
| CM4S, CM4L, CM5L, CM5S, CM5S6, CM6X, CM5X2, CM6S, CM6S2, CM5SF, CM6X1, CM7S, CM7SF, CM8S, CS019S, CS019S2, CM9SF, CM8SF, ICEC7S, ICEC8S2, CS0110S | | | | | | | | | | | | | | |
| TECHNOLOGY _____ | | | 301 | | | | | | | | | | | |
| PHOTO GROUNDRULE _____ | | | 302 <u>300</u> | | | | | | | | | | | |
| CURRENTLY IN PRODUCTION Y OR N _____ | | | 303 | | | | | | | | | | | |
| IF "N" 10% CONTINGENCY ADDED | | | | | | | | | | | | | | |
| FEOL BASE COST EXCLUDES: BR, KV, TAILORS, DUAL GATE AND OP LEVELS | | FULL CAPACITY COST | MATURE FULL CAPACITY COST | | | | | | | | | | | |
| FEOL BASE COST _____ | | 313 | 314 | | | | | | | | | | | |
| FEOL OPTIONAL LEVELS: | | 312 | 310 | | | | | | | | | | | |
| <div style="display: flex; align-items: center;"> <div style="margin-right: 10px;">311</div> <div style="display: flex; align-items: center;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">Y or N</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);"># OF MASK</div> </div> </div> <div style="margin-top: 5px;"> BR RESISTOR KV LEVEL TAILOR VTS DUAL GATE OP RESISTOR EDRAM OPTION: (DT,AE,AW,PP) </div> | <div style="display: flex; align-items: center;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">315</div> <table border="1" style="border-collapse: collapse; text-align: center;"> <tr><td>0</td></tr> <tr><td>0</td></tr> <tr><td>0</td></tr> <tr><td>0</td></tr> <tr><td>0</td></tr> <tr><td>0</td></tr> </table> </div> | 0 | 0 | 0 | 0 | 0 | 0 | <div style="display: flex; align-items: center;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">316</div> <table border="1" style="border-collapse: collapse; text-align: center;"> <tr><td>0</td></tr> <tr><td>0</td></tr> <tr><td>0</td></tr> <tr><td>0</td></tr> <tr><td>0</td></tr> <tr><td>0</td></tr> </table> </div> | 0 | 0 | 0 | 0 | 0 | 0 |
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| 0 | | | | | | | | | | | | | | |
| FEOL OPTIONAL COST _____ | | 317 | 320 | | | | | | | | | | | |
| TOTAL FEOL COST WITH OPTIONS _____ | | 319 | 318 | | | | | | | | | | | |
| BEOL BASE COST EXCLUDES: MC, MIM CAPACITOR, AND TD LEVELS BASED ON 4 THIN LEVELS OF METAL | | FULL CAPACITY COST | MATURE FULL CAPACITY COST | | | | | | | | | | | |
| BEOL BASE COST _____ | | 321 | 322 | | | | | | | | | | | |
| BASE COST = 4 THIN LEVELS OF METAL | | | 320 | | | | | | | | | | | |
| DELETE METAL LEVELS: For products with LESS than 4LM Indicate type of metal and # of levels | | | | | | | | | | | | | | |
| <div style="display: flex; align-items: center;"> <div style="margin-right: 10px;">323</div> <div style="display: flex; align-items: center;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">Y or N</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);"># OF LOM</div> </div> </div> <div style="margin-top: 5px;"> Aluminum Thin Copper Thick Copper </div> | <div style="display: flex; align-items: center;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">324</div> <div style="margin-left: 10px;"> → 25/level for Cu → 60/level for Cu </div> </div> | <div style="display: flex; align-items: center;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">325</div> <table border="1" style="border-collapse: collapse; text-align: center;"> <tr><td>0</td></tr> <tr><td>0</td></tr> <tr><td>0</td></tr> </table> </div> | 0 | 0 | 0 | <div style="display: flex; align-items: center;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">326</div> <table border="1" style="border-collapse: collapse; text-align: center;"> <tr><td>0</td></tr> <tr><td>0</td></tr> <tr><td>0</td></tr> </table> </div> | 0 | 0 | 0 | | | | | |
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| 0 | | | | | | | | | | | | | | |
| 0 | | | | | | | | | | | | | | |

*Shaded boxes need input

FIG.3A

ADD META LEVELS:

For products with MORE than 4LM
Indicate type of metal and # of levels

327 Y or N # OF LOM TO ADD 328

Aluminum
Thin Copper
Thick Copper

25/level for Cu
60/level for Cu

329 330

BEOL BASE COST WITH LEVEL OF METAL ADJUSTMENTS 331

BASE COST ADDER FOR COPPER Y or N 332

333 334 335

ADDITIONAL BEOL LEVELS:
25/LEVEL ADDER FOR CU TECHNOLOGY

MC LEVEL Y or N 336

MIM CAPACITOR TO LEVEL

337 338

ADDITIONAL BEOL LEVELS 339

TOTAL BEOL COST WITH OPTIONS 341

342 340

COST SUMMARY

390

| | PLAN FULL CAPACITY COST | | MATURE FULL CAPACITY COST |
|---|-------------------------------|--|---------------------------------|
| BASE COST | \$0 313 | | \$0 314 |
| OPTIONAL COST | \$0 317 | | \$0 318 |
| RAW WAFER | \$0 351 | | \$0 352 |
| SUPER COMMON | \$0 353 | | \$0 354 |
| SUB TOTAL | \$0 355 | | \$0 356 |
| CONTINGENCY OF 10% (NOT CURRENTLY IN PRODUCTION) | \$0 357 | | \$0 358 |
| TOTAL PREDICTED COST | \$0 359 | | \$0 360 |

*Shaded boxes need input

FIG.3B

FIG.3A

FIG.3B

FIG.3C

EQUATIONS FOR TECHNOLOGY COST ESTIMATE WORKSHEET

| FEATURE | FULL CAPACITY COST EQUATION | MATURE COST EQUATION | WHERE: | HOW DERIVED |
|---------------|-----------------------------|----------------------|--|------------------------|
| FEOL BASE | $Y=272X^{-0.53}$ | $Y=241X^{-0.493}$ | $Y = \text{FEOL Base Cost}$ $X = \text{Groundrule}$ | Least Squares Analysis |
| BEOL BASE | $Y=417X^{-0.486}$ | $Y=388X^{-0.461}$ | $Y = \text{BEOL Base Cost}$ $X = \text{Groundrule}$ | Least Squares Analysis |
| BR RESISTOR | $Y=15.1X^{-0.362}$ | $Y=13.5X^{-0.352}$ | $Y = \text{BR Resistor Cost}$ $X = \text{Groundrule}$ | Least Squares Analysis |
| KV LEVEL | $Y=15.5X^{-0.297}$ | $Y=12.5X^{-0.489}$ | $Y = \text{KV Level Cost}$ $X = \text{Groundrule}$ | Least Squares Analysis |
| TAILOR VTS | $Y=49.8X^{-0.048}$ | $Y=45.9X^{-0.0302}$ | $Y = \text{Tailor Vts Cost}$ $X = \text{Groundrule}$ | Least Squares Analysis |
| DUAL GATE | $Y=38.2X^{-0.803}$ | $Y=33.7X^{-0.815}$ | $Y = \text{Dual Gate Cost}$ $X = \text{Dual Gate Levels}$ | Least Squares Analysis |
| OP RESISTOR | $Y=19.8X^{-0.512}$ | $Y=17.9X^{-0.502}$ | $Y = \text{OP Resistor Cost}$ $X = \text{Groundrule}$ | Least Squares Analysis |
| MC LEVEL | $Y=58.8X^{-0.597}$ | $Y=53.9X^{-0.584}$ | $Y = \text{MC Level Cost}$ $X = \text{Groundrule}$ | Least Squares Analysis |
| METAL LEVELS | $Y=111X^{-0.302}$ | $Y=103X^{-0.282}$ | $Y = \text{Metal Level Cost}$ $X = \text{Groundrule}$ | Least Squares Analysis |
| MIM CAPACITOR | $Y=34.2X^{-0.523}$ | $Y=30.8X^{-0.533}$ | $Y = \text{MIM Cap Cost}$ $X = \text{Groundrule}$ | Least Squares Analysis |
| TD LEVEL | 85 | 77 | NA | Direct Measurement |
| EDRAM | 475 | 450 | NA | Direct Measurement |
| CU ADDER | 100 | 80 | NA | Direct Measurement |

FIG. 4

TECHNOLOGY COST MODEL OVERVIEW

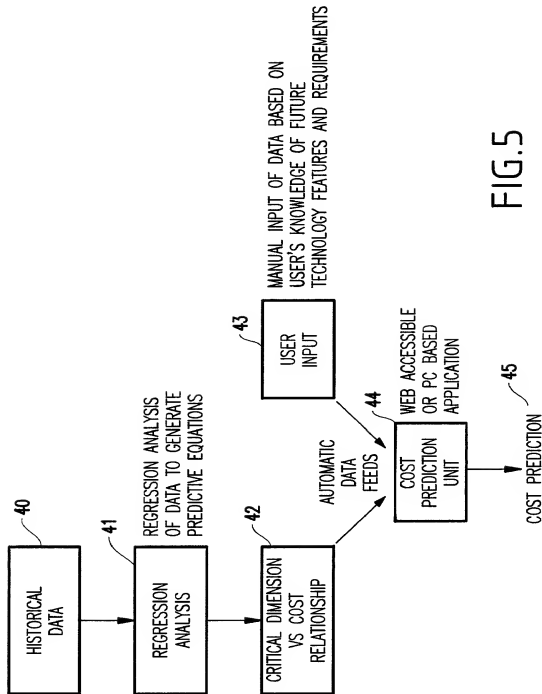


FIG.5

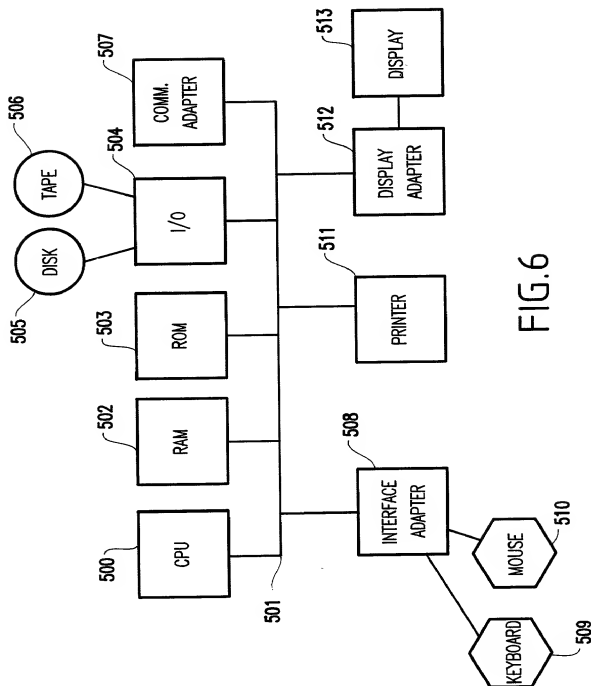


FIG. 6